

REMARKS

Claims 1-24 are currently pending in the subject application, and are presently under consideration. Claims 1-24 stand rejected. Claims 10, 11, 13 and 14 have been amended. Favorable reconsideration of the application is requested in view of the amendments and comments herein.

I. Objection of Claims 10 and 14 due to informalities:

Informalities in claims 10 and 14 have been corrected as suggested in the Office Action. The Applicant respectfully requests that the objections to of claims 10 and 14 be withdrawn.

II. Rejection of Claims 8, 9, 13, and 14 under 35 U.S.C. 112

The Office Action rejects claims 8, 9, 13 and 14 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

The Office Action contends that “null-directory protocol” was not properly defined and described in the specification. Applicant respectfully disagrees. First, this rejection appears inconsistent with the rejection of claim 8 in which the Office Action contends that such claim is disclosed in U.S. Patent Publication No. 2004/0002992 A1 to Cypher et al. Applicant also submits that null-directory protocols are well known in the art and the present application would reasonably enable a person of ordinary skill in the art of memory cache coherency protocols to make and use a system according to claim 8. Additionally, at paragraph [0054], the present application states in “a null-directory-based protocol, for example, the memory 110 includes home nodes for each cache line. Instead of issuing a broadcast to all cache targets, the source issues a single request to the home node for such data.” Another example of a null-directory cache coherence directory protocol can be found in U.S. Patent No. 6,725,343 to Barroso et al. See, *e.g.*, Barroso et al. at Abstract line 17. For these reasons, Applicant respectfully requests that the rejection of claim 8 be withdrawn.

The Office Action rejects claim 9 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement, alleging that the term “incomplete protocol” was not properly defined and described in the specification. Applicant respectfully disagrees. The specification, in discussing an example of an incomplete protocol, states that a source snoop protocol may be considered an incomplete protocol since there are circumstances that

require the use of a correctness protocol (e.g. a forward progress protocol) in which all transactions can be deterministically resolved. See the present application at paragraph [0029]. Since the present application reasonably enables a person of ordinary skill in the art of memory cache coherency protocols to make and use a system according to claim 9, Applicant respectfully requests that the rejection of claim 9 be withdrawn.

The Office Action contends that there is insufficient antecedent basis for “the ownership data response” recited in claim 13. Claim 13 has been amended to provide proper antecedent basis for claim 13. Applicant respectfully requests that the rejection of claim 13 be withdrawn.

The Office Action contends that there is insufficient antecedent basis for “the system” recited in claim 14. Claim 14 has been amended to correct a typographical error in this claim. Applicant respectfully requests that the rejection of claim 14 be withdrawn.

III. Rejection of Claims 1-24 under 35 U.S.C. 102

Claims 1-2 stand rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Publication No. 2004/0002992 A1 to Cypher et al. (“Cypher et al.”). Applicant traverses these rejections for the following reasons.

Applicant respectfully disagrees with the contention that Cypher et al. discloses claim 1. Cypher et al. fails to teach, suggest or disclose that a node having an associated cache including data having an associated first cache state that is capable of identifying the first node as being an ordering point for serializing requests from other nodes for the data. Cypher et al. teaches various ordering points are established within a node. See Cypher et al. at paragraph [0075]. Cypher et al. further discloses that one such ordering point is the Broadcast Network and the Broadcast Network is the ordering point for cacheable BC mode transactions corresponding to a given memory block. Cypher et al. at paragraph [0075]. However, nothing in Cypher et al. teaches or suggests that a cache state is capable of identifying the node as an ordering part for serializing requests from other nodes for the data as recited in claim 1.

The general description of shared memory multiprocessing systems in Cypher et al., which are being relied on in the Office Action, teaches that such systems are generally deploying either a broadcast snooping cache coherency protocol or a directory based cache coherency protocol. See Cypher et al. at paragraph [0007]. However, this general description of related art in Cypher et al. fails to disclose claim 1. Moreover, the entire

description of related art section in Cypher et al. also fails to teach disclose, or suggest the relationship between cache data, cache states and ordering points as recited in claim 1. See Cypher et al. [0002] to [0010].

The Office Action also cites paragraph [0062] of Cypher et al., which is directed to a description of the Exemplary Processing Subsystem. This section of Cypher et al. describes a processing subsystem 142A that may receive coherency demands via address queue 720C. See Cypher et al. at paragraph [0062] and FIG. 7. Cypher et al. discloses that if a processing subsystem receives a transaction corresponding to a read-to-own request for a memory block which is modified in cache 710, the corresponding memory block may be returned via data out queue 720A and its state information 712 for that block may be changed to invalid. See Cypher et al., at paragraph [0062] lines 3 to 8, and FIG. 7. In addition, Cypher et al. et al. discloses that if processing subsystem 142A receives an invalidate demand for a memory block whose state is shared within cache 710, state information 712 may be changed to indicate the memory block is no longer valid within cache 710. Cypher et al. at paragraph [0062] lines 8-12. However, this description of the processing subsystem 142A (and Cypher et al. as a whole) fails to teach, disclose or suggest elements of claim 1. See, *e.g.*, Cypher et al. at paragraph [0059] to [0062].

Since Cypher et al. fails to disclose claim 1, claim 1 is not anticipated by Cypher et al. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 1 as well as claims 2 – 10 that depend from claim 1.

Claim 2 is dependent upon claim 1 and should be allowable over Cypher et al. at least for the reasons stated previously for claim 1. The description of systems employing broadcast protocols in Cypher et al. states that coherence requests may be provided directly to all processors unconditionally. See Cypher et al. at paragraph [0009]. Such teachings, however, fail to teach, suggest or disclose that the first cache state enables the first node to provide a data response to a request for the data from a second node for the data without updating a system memory. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 2.

Claim 3 is dependent upon claim 1 and should be allowable over Cypher et al. at least for the reasons stated previously for claim 1. The Office Action contends that Cypher et al. discloses claim 3. In contrast to this contention, Cypher et al. fails to teach, disclose or suggest that the ownership data response transfers the ordering point from the first node to the second node as recited in claim 3. Instead, Cypher et al. teaches that various ordering

points are established within the node and that these ordering points govern ownership and access right transitions. See Cypher et al. at paragraph [0075] lines 1 to 3. Cypher et al. also teaches that the Broadcast network or client may serve as an ordinary point, but Cypher et al. fails to teach that an ownership data response that transfers the ordering point, as recited in claim 3. See Cypher et al. at paragraph [0075] to [0076]. Specific examples relating to a read-to-own request are provided at paragraphs [0068] to [0071], in each of which the home agent remains the ordering point. Since Cypher et al. fails to disclose claim 3, claim 3 is not anticipated by Cypher et al. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 3.

Claim 4 is dependent upon claim 3 which should be allowable over Cypher et al. at least for the reasons stated for claim 3. Additionally, Cypher et al. fails to teach/suggest that an ownership data response is made without updating a system memory. Cypher et al. discloses that a home agent generally corresponds functionality within a home memory system. See Cypher et al. at paragraph [0066] lines 4-8. Then Cypher et al. discloses that a home memory subsystem 130 updates its directory. See Cypher et al. at paragraph [0068] and Fig. 8A. Therefore, Cypher et al. discloses changing a system memory (i.e. the directory) in response to a read-to-own coherency request. See Cypher et al. at paragraph [0068] and Fig. 8A. Additionally Cypher et al. discloses that a request agent 100 sends a read-to-own request to home agent 102. See Cypher et al. at paragraph [0069] and Fig 8B. Cypher et al. then recites that the home agent then mark the requestor 100 as the sole owner of the line (by updating its directory), but Cypher et al. fails to teach that an ownership data response transfers an ordering point as recited in claim 3. See Cypher et al. at paragraphs [0068] to [0071]. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 4.

The Office Action contends that Cypher et al. discloses claim 7. Applicant respectfully disagrees with this contention. Claim 7 is dependent upon claim 5 which should be allowable over Cypher et al. at least for the reasons stated previously for claims 3 and 5. Additionally, the Office Action contends that paragraph [0007] of Cypher et al. discloses the subject matter recited in claim 7. However, paragraph [0007] states that “shared memory multiprocessing systems generally employ either a broadcast snooping cache coherency protocol or a directory based cache coherency protocol.” Nothing in paragraph [0007] even suggests a hybrid cache coherency protocol as recited in claim 7. The approach disclosed in Cypher et al. enables the use of mixed broadcast snooping and directory based coherency

protocols by employing a switch and other supporting components (a mode unit) by changing the transmission modes corresponding to the type of received transaction (*e.g.*, a broadcast mode or point-to-point mode). See Cypher et al. at paragraphs [0011] to [0013] and paragraphs [0036] to [0040] under the heading Hybrid Network Switch. Accordingly, Cypher et al. teaches that the type of protocol implemented is dependent upon information in a mode table based upon the request transaction received. Cypher et al. at [0038]. In contrast, claim 7 recites that each of the first and second processors employs a source broadcast based protocol to issue a request for data and employs an associated forward progress protocol to reissue a request for the data if the request fails in the source broadcast protocol. Accordingly, reconsideration and allowance of claim 7 is requested.

Claim 8 depend from claim 5 and should be allowable over Cypher et al. at least for the reasons stated previously for claims 1, 3 and 5. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 8. The Office Action contends that Cypher et al. discloses that the forward progress protocol comprises a null-directory protocol citing paragraphs [0032] and [0068] of Cypher et al. In contrast to the contention in the Office Action, the protocol identified and described in paragraph [0068] of Cypher et al. appears to refer to a traditional directory based protocol in contract to a null-directory protocol. For example, paragraph of Cypher et al. discloses that the home agent detects the shared state for one or more other clients, which information would be based upon coherency information stored in the directory, which corresponds to a standard directory and not a null-directory protocol. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 8.

Claim 10 is dependent upon claim 1 which should be allowable over Cypher et al. at least for the reasons stated previously for claim 1. Additionally, claim 10 recites a system capable of assigning a cache state to cache lines to identify the states of data cached in the cache line being selected from a group consisting of a plurality of different cache states as recited in claim 10. The Office Action refers to paragraphs 52, 62, 67, 51, 68, 69, 71, 51 and 75 to identify purported teachings in Cypher et al. to support the contentions that Cypher et al. discloses the subject matter recited in claim 10. However, claim 10 recites a plurality of different possible cache states that can be assigned to a cache line. In sharp contrast, Cypher et al. at paragraphs [0051] and [0052] discloses certain general attributes of a cache coherency protocol that can be utilized by the system. Specifically at paragraph [0052], Cypher et al. discloses the well-known MOSI cache coherency protocol that can be utilized

by the memory subsystems disclosed in the Cypher et al. patent. Applicant submits that the combination of cache states recited in claim 10 includes states not taught or suggested in Cypher et al. nor is the combination of cache states known in other art of record. As but one example, the Office Action refers to paragraphs [0051] and [0075] to identify a teaching in Cypher et al. corresponding to a cache state that indicates the cache line is transitioning between cache states (the last paragraph of claim 10). However, as discussed above, paragraph [0051] includes no mention of a cache state that can be utilized to indicate a cache line as transitioning between cache states. Paragraph 75 also fails to teach or suggest that a cache state would indicate a cache line as transitioning between cache states. In particular, paragraph 75 simply identifies that ordering points are established within a node to govern ownership and access right transitions. However, Cypher et al. here and elsewhere is silent as to any cache state that might indicate a cache line is transitioning between cache states. For at least these reasons, reconsideration and allowance of claim 10 is respectfully requested.

Regarding claims 11 – 14, the Office Action refers respectively to the rationale set forth previously in the Office action with respect to claims 1, 2, 3 and 10. Applicant respectfully traverses the rejection of these claims for at least those reasons set forth above with respect to claims 1, 2, 3 and 10, respectively. Additionally, claim 11 has been amended to expressly recite that the ordering point for the data is associated with the at least one associated cache of one of the processor nodes. As discussed above with respect to claim 1, Cypher et al. teaches that ordering points are established within the node to govern ownership and access right transitions, but Cypher et al. fails to teach or suggest that the ordering point is associated with the at least one associated cache of one of the processor nodes, as recited in amended claim 11. See, *e.g.*, Cypher et al. at paragraph [0075]. Thus, for this reason and the reasons set forth above with respect to claim 1, reconsideration and allowance of claim 11 are respectfully requested.

Claim 12 is patentable over Cypher et al. for at least those reasons set forth above with respect to claims 1 and 2. Since Cypher et al. fails to teach or suggest that a first cache state at first node of a plurality of processor nodes identifies the first node as an ordering point for the data as recited in claim 12, claim 12 is patentable over Cypher et al..

Claim 13 is patentable over Cypher et al. for at least those reasons set forth above with respect to claim 3. For example, as discussed above, Cypher et al. fails to teach that an ownership data response transfers the ordering point from the first node to the second node as

recited in claim 13. See Cypher et al. at paragraphs at paragraph [0075] through [0076]. Reconsideration and allowance of claim 13 are respectfully requested.

Claim 14 is patentable over Cypher et al. for at least those reasons set forth above with respect to claim 10. Applicant respectfully requests reconsideration and allowance of claim 14.

The Office Action contends that Cypher et al. discloses claim 15 by relying on the rationale for the rejection of claim 1 in support of the rejection of claim 15. Applicant respectfully disagrees with this contention. Similar to as argued for claim 1, Cypher et al. teaches that various ordering points are established within the node, but fails to teach, disclose or suggest means for associating a cached ordering point for the block of data with a first node of the system as recited in claim 15. Instead, as discussed above, Cypher et al. discloses that ordering points can be established such as the broadcast network or that a client may serve as an ordering point. However, Cypher et al. fails to teach/suggest use of a cached ordering point to serialize requests for a block of data from nodes of the system as recited in claim 15. Since Cypher et al. fails to teach the use of a cached ordering point, Cypher et al. consequently also fails to teach or suggest means for association in the cached ordering point with a node of the system also is recited in claim 15. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 15.

Claim 16 further recites that the means for associating an ordering point comprises for means for assigning a first cache state to the first node of the system. Similar to as discussed above with respect to claims 2 and 12, Cypher et al. fails to teach or suggest that a cached ordering point for a block of data can be associated with the node of the system by means for assigning a cached state to the first node of the system as recited in claim 16. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 16.

Claim 18 is dependent upon claim 15 which should be allowable over Cypher et al. at least for the reasons stated previously for claim 15. Similar to argued for claim 3, Cypher et al. fails to teach, suggest or disclose an ownership data response can be provided to transfer the ordering point from the first node to the second node as recited in claim 18. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 18.

The Office Action contends that Cypher et al. discloses claim 19 and relies on the rationale for the rejection of claims 1 and 3 to support of the rejection of claim 19. Applicant respectfully disagrees with this contention. As similarly argued for claims 1 and 3, Cypher et al. fails to disclose, teach or suggest a method of employing a first cache state to identify a

first node of a system as being an ordering point for a block of data. Instead, as discussed above, Cypher et al. identifies that certain nodes such as broadcast network or client may serve as ordering points but does not disclose that a cache state can be used to identify a node as being an ordering point for a block of data. For these reasons and those set forth above with respect to claims 1 and 3, Applicant respectfully requests reconsideration and allowance of claim 19.

Claim 20 is dependent upon claim 19 which should be allowable over Cypher et al. at least for the reasons stated previously for claim 19 as well as for those reasons discussed above with respect to claim 2. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 20.

Claim 21 is dependent upon claim 19 and should be allowable over Cypher et al. at least for the reasons stated previously for claim 19 as well as for reasons similar to those discussed above with respect to claims 2 and 3. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 21.

The Office Action contends that Cypher et al. discloses claim 22 and relies the same rationale for the rejection of claim 7 to support the rejection of claim 22. Applicant respectfully disagrees with this contention. Claim 22 is dependent upon claim 19 and thus should be allowable over Cypher et al. at least for the reasons stated previously for claim 19. Claim 22 also is patentable over Cypher et al. for reasons similar to those stated above with respect to claim 7. For example, Cypher et al. fails to teach or suggest that a forward progress technique is employed to deterministically resolve the request from the node for a block of data if the request from the second node cannot be deterministically resolved through employing the source broadcast protocol. In contrast, Cypher et al. discloses a table and switch that are utilized to identify and employ a protocol mode based on predetermined criteria which are not specified as corresponding to the subject matter recited in claim 22. See, *e.g.*, Cypher et al. at paragraphs [0038] and [0057]. For these reasons, Applicant respectfully requests reconsideration and allowance of claim 22.

Claim 23 depends from claim 22 and thus should be allowable over Cypher et al. at least for the reasons stated previously for claim 22 as well as for reasons similar to those discussed above with respect to claim 7.

The Office Action contends that Cypher et al. discloses claim 24 and relies on the same rationale previously stated for the rejection of claim 1 to support of the rejection of claim 24. Applicant respectfully disagrees with this contention. Claim 24 is allowable over

Cypher et al. for reasons similar to those stated previously for claim 1. For instance, Cypher et al. fails to teach or suggest a protocol that is operative to assign a cache state to a cache line of one node of a plurality of nodes in a system in which this cache state defines the one node as an ordering point in the system for data in the cache line of the one node. As discussed repeatedly herein, Cypher et al. fails to teach or suggest that a cache state defines a node as an ordering point. Instead, Cypher et al. simply discloses that ordering points are established within the node to govern ownership and access right transitions examples of ordering points are provided including a broadcast network and a client. See Cypher et al. at paragraphs [0075] and [0076]. However, Cypher et al. fails to teach or suggest that a cache state has any bearing on what constitutes an ordering point. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 24.

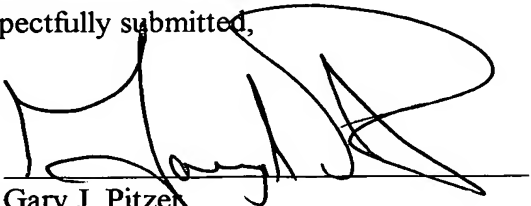
IV. CONCLUSION

In view of the foregoing remarks, Applicant respectfully submits that the present application is in condition for allowance. Applicant respectfully requests reconsideration of this application and that the application be passed to issue.

Should the Examiner have any questions concerning this paper, the Examiner is invited and encouraged to contact Applicant's undersigned attorney at (216) 621-2234, Ext. 106.

No additional fees should be due for this response. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

Respectfully submitted,

By: 
Gary J. Pitzer
Registration No. 39,334
Attorney for Applicant(s)

CUSTOMER NO.: 022879

Hewlett-Packard Company
Legal Department MS 79
3404 E. Harmony Road
Ft. Collins, CO 80528